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SCIENCE AND TECHNOLOGY

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WEST EUROPE REPORT

SCIENCE AND TECHNOLOGY

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ADVANCED MATERIALS

BRIEFS

KRUPP POWDER METALLURGY R & D--Powder metallurgy offers advantages for the manufacture of complicated components: it is possible to produce low-segregation powder and use it to manufacture raw pressings, which can be compressed into compact, "near-net-shape" components in a single processing step using the hot isostatic press process. The parts are decidedly homogeneous in their material composition and are resistant to high mechanical stresses. According to Fried. Krupp GmbH, the company's Research Institute in Essen is intensively concerned with the possibilities of introducing titanium and super alloys into powder metallurgy. Rotation pulverization is one notable way to manufacture powder from this kind of metals. Krupp has access to this kind of unit with a yearly capacity of about 15 tons. An electrode rotates in the center of this unit at a speed of 5000 rpm. The frontal surface of the titanium or super alloy electrode is liquefied by electron bombardment. In the process, droplets of material are spun off and fly against an annular deflector shield, break up, and solidify into a powder during free-fall. According to Krupp, a special turning process makes it possible to maintain continuous operation, which is very important for the purity of the powder. Krupp is also testing another method for manufacturing powder from super alloys. They have recently built an inert gas atomization facility, with which they intend to produce metal powder out of nickel-based super alloys. [Article by re "Pulverization of Rotating Titanium Electrodes: Krupp Experiments with Powder Metallurgy for High Quality Components" Frankfurt] [Text] [Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 3 Mar 86 p 7] 13127

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AEROSPACE

ESA GENERAL DIRECTOR REIMAR LUEST ON EUROPE'S GOALS IN SPACE

Duesseldorf VDI NACHRICHTEN in German 10 Jan 86 p 8

[Article by Egon Schmidt: "Should Europe Reach for the Stars?"]

[Text] Munich 10 Jan 86--Europe, it is true, has not yet put a man on the moon, and indeed has no independent ability to put astronauts even into an orbit near the earth. And yet it is entirely reasonable for the European countries to become more active in space. If only in order not to miss the boat entirely in the long run. This is, at its simplest, the opinion of Professor Reimar Luest, Director General of the European Space Organization (ESA).

It is actually remarkable, mused Luest in his keynote speech before the German Air and Space Research and Experimentation Institute (DFVLR) in Munich, "how many doubts keep on being raised right here with us," when it comes to the question of whether space activities make sense for us Germans. And he stated that, precisely from his present viewpoint of a person living abroad, it seemed to him "that we are actually still finding it harder than other countries, especially France, to see the advance into space as a national task and thus also as a European one." But "I think the subject of Peenemuende and the 'V2' has something to do with it."

And a second factor, he felt, must be added, in order to explain the widewpread space skepticism of many an inhabitant of our country. "Space activities cannot be carried out without booster rockets, but rockets were originally developed exclusively for military purposes." And thus space technology is often seen, especially in our country, in immediate connection with military technology; here, however, it is "overlooked that this also holds in the same way for other areas of technology."

Looking back to the beginnings of space travel, Luest set forth a noteworthy difference between Europe on the one hand and the United States and the USSR on the other: after the "sputnik shock" of 28 years ago, it was "after all scientists in Europe who got together after the first American and Soviet launches,

to develop plans for European cooperation in the field of space research." For, as Luest says, they were quite aware that this field was "important for both science and technology," and that cooperation was necessary here in the European framework. In this, they had in mind, as the "model for cooperative activity," the "successful European facility for nuclear physics 'CERN' in Geneva. Precisely here in the Federal Republic of Germany, the impetus for the advance into space came exclusively from scientific objectives."

Today, 10 years after the founding of ESA, the question of what we have to gain in space is asked in practically the same way as it was then. But this is the kind of question a man like Luest can answer in a large number of ways off the top of his head. Space exploration, "with its broad spectrum of different scientific disciplines," is an "important component of basic research," as he put it. It is both "an expression of human culture and the human drive to learn, and also the seed-bed for technological innovation."

Space technology, again, is significant not only for carrying out the actual space-exploration projects, but also "for other areas of knowledge, for example, management and industrial structure." For the big space projects "can somewhat compensate, in part, for the innovative effects of the military research and development that is missing in Europe, and thus make an important contribution to the competitiveness of German and European industry."

Further, Luest reminded his audience, a new market — as for booster systems and satellites — has arisen because of space activities, and microgravity conditions have created a new and as yet totally incalculable potential for economic and industrial activity. Nor should the communications satellites be forgotten: on the one hand, they are commercially significant and, on the other, they have "revolutionized global communications."

Other satellites — especially in cooperation with supercomputers — will contribute to making weather forecasting more precise and, in general, "many areas will profit" from satellite-based geographic exploration. This raises in concrete form the question as to who really profits from the knowledge satellites deliver, which is after all often a rather exclusive kind of knowledge. And then, the question as to who may be left with the losses....

In this connection, a partial aspect of the well-known military "usability" of space (which we will not pursue further here) becomes interesting. Luest put it this way: only the United States can today collect relevant information about the "other side," that is the USSR, by means of satellites. America's

allies (and for this Luest cited a relevant expert) are dependent "exclusively on American data and on American willingness to reveal that data."

Which has the consequence that the United States can influence international discussion through a policy of information management. This makes the U.S. the actor, while Europe is merely passive....

A further weighty argument for space activities, however, is just the success to date. For, according to Luest, ESA and its predecessors have up to now launched 14 scientific satellites, all of which worked! In these satellites, "the experimental contributions from the Federal Republic were considerably higher as a percentage than was our financial contribution," and we have been successful ever since "in selecting scientific experiments only on the basis of their scientific quality and not according to any quota system."

At the national level, the Federal Republic of Germany has "successfully launched" 3 satellite projects to date (Azur, and Aeros 1 and 2), as well as the 2 sun probes Helios 1 and 2. These latter, by the way, remained active 10 times longer than was originally specified — a good advertisement for Made in Germany, as can be seen.

In the so-called "applications area," the Europeans have up to now "successfully launched" 7 weather and telecommunications satellites, as Luest was happy to report. And as early as 1986, "the world's first directly receivable TV satellite" will be launched. Other satellites are under construction.

How important booster rockets are for those who build such good satellites, was called to mind by Luest with the observation that the Americans "were not prepared to give the Europeans a commitment for the launching of European communications satellites" at the beginning of the seventies! For this reason, the French insisted in 1973 on developing their own "Ariane" rocket, with which it has now "in fact been possible, to break the Americans' monopoly position in the field of booster rockets." As to the aborted launch of just such an Ariane that was only recently rather spectacularly put on display (it was the first, after 9 successful and 2 aborted launches in the early development phase), Luest was of the opinion that, while this was indeed "very distressing, it did not represent any catastrophe." Especially as "technical reliability standards are, for cost reasons, not set as high for an unmanned-space-flight booster as they are for a booster that is to put people into space."

According to Luest, the Ariane "won half of the market for

commercial satellite launches last year (1984)," while it at the same time also put "satellites into geostationary orbit with a greater success rate." The Americans "don't like this competition at all," and are trying to win back market shares for their manned shuttles by means of "heavy subsidies for launch costs."

Very soon now there will be 4 versions of the Ariane for different payloads. To date, 37 confirmed bookings for Ariane launches have come in, with a value of 3 billion marks, as well as 13 options.

In order to be able to continue strengthening Europe's autonomy in the future as well, the Europeans want to go on with development of space activities through their ESA, thereby completing 2 or 3 big projects: for one thing, a so-called "independent contribution" by the Europeans to the space station the Americans are planning, and then a new Ariane — "version 5," with a big cryogenic drive. The Europeans have practically achieved unity on both projects, although the final decisions will only be made in about a year. Whether ESA will accept the manned space vehicle "Hermes," suggested by France, into its program is, on the other hand, still under discussion.

This Hermes would, as is well known, be launched by the Ariane 5, a rocket that, beginning in around 1995, is to be able to put a payload of 4.5 tons into geostationary orbit, and as much as 15 tons into geosynchronous orbit. At the same time, the maximum diameter of the payload will amount to a respectable 4.5 meters.

Luest clearly advocated development of the manned space vehicle. For "only thus" will we be able to have an "access to the space station independent of the Americans," and "only then" is participation in the latter "reasonable for the long term." The ESA director general expressed himself further: "In my judgment, the situation today is fully comparable to that of 1973. The French were then pushing for development of the Ariane, to secure a certain amount of autonomy in unmanned space flight. The issue today is the corresponding autonomy in manned space flight."

On the subject of autonomy: Luest said that Europe will also develop a data-link satellite which is to ensure communications with the space station, but also with other satellites. For in this case, too — "as in all other fields" — it is important "that Europe face no United States monopoly."

But can Europe even finance its ambitious projects? Anyone asking this question receives the answer from Luest that, for civilian space flight alone(!), 68 marks per taxpayer is spent in the United States, but in Europe only 5.50 marks. We should actually, "given the complexity of the European economic market,

be spending more here in Europe for research and development than they do in the United States, and this is true also for space research and space technology." For Europe is after all actually "on a par with the United States in population and economic power."

In a comparison between the Federal Republic and France, it is striking that our neighbors spend about half again as much as we do on their civilian space program, and that they have military activities over and above this. And also that France, "with the Ariane program and, as I believe, with the Hermes-program" has put forward "two projects that are decisive for Europe, and which the Federal Republic of Germany has followed in each case only with hesitation and with considerably more modest financial participation." "This," said Luest to the gathering of the industry in question, "has naturally not remained without repercussions upon the ability to uphold the best interests of industry in the Federal Republic of Germany."

Germany should, in addition to its European-oriented space program, also plan and carry out independent projects and cooperative efforts in bilateral or trilateral frameworks, Luest advised, and, over and above this, should, "time after time, promote technological development efforts in a timely manner, so that German industry can win a favorable starting position for future space projects."

In the European framework, however, industrial policy must "not be confined to expending more and more rhetoric on an effort to find a solution to the problem — not even mathematically solvable — that each member nation wants back in industrial contracts at least 110 percent of the contributions it pays in. Of course each member nation must be given a return "as close as possible to 100 percent" but this "can't happen at the expense of all competition."

Further, Luest continued, it will "not be tolerable in the long run that Europe's big space firms always automatically get their turns to be prime contractors, while the small and middle-sized firms are exposed to competiton." A process in which "the latters' position is, if possible, even further weakened by the fact that the big firms are more and more taking over responsibility for the development of component manufacture."

Not only did Luest advocate more consideration for the smaller ESA countries and their smaller enterprises, but he also asked for a softening of "rigid national procurement policies in the large member countries," if achievement of "basic progress in industrial policy" was desired.

For "only thus will stable European industrial consortia be

formed, which can then also compete successfully on the world market. Here I'm thinking primarily of the field of communications."

For surely, given its potential, Europe actually ought not to be at all inferior. In population as well as in economic strength, as Luest has always said, it can completely measure up to the United States, if it wants to. At least in theory....

13070
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BIOTECHNOLOGY

SCOTTISH BIOTECH POTENTIAL REVIEWED

Paris BIOFUTUR in French Feb 86 pp 59-60

[Text] Damon Biotech Inc. holds key patents in the area of encapsulated cell culture (Encapcel TM), especially for the production of monoclonal antibodies, and in the use of specific "enhancing" DNA sequences, which, combined with gene coding for proteins of therapeutic interest such as TPA (Footnote 1) (Tissue Plasminogen Activator), considerably stimulate their production (Footnote 2) (The "enhancer" used is a DNA sequence discovered in 1983 at MIT (Massachusetts Institute of Technology), which is responsible for the production of large amounts of Immunoglobulin G heavy chain.).

Production of Monoclonal Antibodies on an Industrial Scale

The cellular microencapsulation technique developed by this company has proved to be quite ingenious and effective for culturing different types of cells, including hybridomas. These immortal monoclonal antibody-producing cells are encapsulated under physiological conditions and their viability is maintained with chemical reagents. The process involves four steps:

--the hybridomas (2.10^6 cells/ml) are suspended in a solution of sodium alginate having the same concentration as normal saline;

--the cell suspension is fractionated into droplets collected in a dilute solution containing divalent cations (Ca^{2+}); in the presence of these ions, the sodium alginate gels, thus isolating the cells contained in these droplets from the aqueous phase;

--a porous semipermeable membrane is placed on each gel sphere by adding a polymer composed of reactive amine or imine chemical groups;

--the alginate gel is redissolved by the addition of divalent ion-chelating agents. It leaves the capsule through the membrane pores. Only the hybridomas remain encapsulated.

Placed in a reactor supplied with nutritive elements, the hybridomas, as well as oxygen required for cell growth, easily diffuse into these capsules by means of membrane pores. Horse serum, which is quite expensive, may be

used at a relatively low concentration in the culture medium. The hybridomas grow rapidly until concentrations not previously achieved in conventional in vitro culture or ascites fluid are attained: greater than 5.10^6 cells/ml--a density comparable to that observed in living tissue! During this entire growth period, monoclonal antibodies are synthesized with yields 1,000 times greater than conventional cultures (5 to 20 grams/40 liter reactor/2 to 3 weeks)! Finally, another benefit of the Encapsel TM process, the monoclonal antibodies, may represent 45 to 80 percent of the proteins trapped, which are prepurified by dialyzing microcapsules with a saline solution, thus eliminating certain contaminants. The membrane is then physically fragmented, thereby liberating the antibodies. In certain cases, 98-percent-pure antibodies have been obtained. The ability to produce approximately 12 kg of monoclonal antibody annually was demonstrated in this company's Boston research unit.

On 17 October in Livingston, near Edinburgh, a program took place which celebrated the creation of new Damon Biotech production facilities at a cost of 30 million pounds. These facilities will have a surface area of 10,000 m^2, employ approximately 300 people and will have 10 times the capacity of the facilities presently located in Boston. This is the largest monoclonal antibody production unit in the world, with an annual production capacity estimated at more than 120 kg of monoclonal antibodies. (Footnote 3) (The capital for this Biotech (UK, Ltd., Director Nigel Webb, previously director of research of the Searle cell culture group) venture has received contributions from the British Government, the Advent International Investment group and a European consortium. Eighty percent of the new company belongs to Damon Biotech Inc.)

Worldwide Demand for Monoclonal Antibodies

With regard to this industrial development, one might wonder what the worldwide demand for monoclonal antibodies will be. This question was, of course, discussed during this program and the resulting response was that demand would be limited to the clinical use of antibodies.

Professor Bagshawe (Charing Cross and Westminster Medical School) emphasized the qualitative improvement in diagnostics, for the identification of agents responsible for viral and bacterial diseases within 1 or 2 hours instead of several days as with conventional techniques, as well as for the classification of blood groups, the identification of tissues and the prognosis for different forms of leukemia. An interesting new development is the purification of bone marrow, which consists of removing tumor cells by specifically killing them outside the body with antibodies in combination with complement.

Professors Bagshawe, James (University of Edinburgh) and Baldwin (University of Nottingham) have clarified the application of MCA (Footnote 4) (Monoclonal antibodies) to oncology: cytologic staining of tumor cells, for example with antibodies directed against carcinoembryonic antigens (creatine phosphatase is frequently used in the immunoenzymatic staining method); imaging of tumors, consistins of combining radiolabeled monoclonal antibodies with tomography. This method provides much greater resolution than previous techniques such as

nuclear magnetic resonance. It also allows tumors of less than 1 mm in diameter to be detected. It is hoped that all these applications will result in qualitative improvements in speed, reproducibility, sensitivity, and specificity.

The idea for the large-scale use of monoclonal antibodies for clinical applications was derived from developments that have occurred in the area of tumor detection in which antibodies directed against tumor antigens are coupled to toxic agents (for example toxins or drugs, such as methotrexate). Basic problems still exist. Dr Reisfeld (Scripps Institute) reported on his work concerning the development of new immunotherapies for melanoma and lung cancer (adenocarcinoma). Phase 1 of the clinical studies testing toxicity has started and the first two patients are now in Phase 2 of the study. Extrapolations from studies carried out with mice indicate that doses of 10 g of conjugated antibodies are necessary, resulting in an annual market on the order of 100 kg of monoclonal antibodies for this type of therapy.

Currently, the only large-scale use of monoclonal antibodies is in the purification of pharmaceutical products such as alpha interferon, for which Eli Lilly is currently the biggest customer of Damon Biotech products.

It remains to be seen whether the predicted market for monoclonal antibodies will attain the predicted volume of $2 billion.

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CIVIL AVIATION

REPORT CASTS DOUBTS ON AIRBUS INDUSTRIE SURVIVAL

Brussels LE SOIR in French 12 Mar 86 pp 1,6

[Article by Olivier Collot: "Airbus Threatened: Sonaca Is Worried"]

[Text] Will the Airbus project go beyond 1990? There is in any case a threat hanging over the European transport plane which, if the confidential report we have read is to be believed, is apparently suffering both from a serious slump, in its first versions, and from a lack of decisions which are indispensable for the development of a strategy which might make its survival possible.

The matter is followed with a great deal of attention in Belgian aeronautical circles, and more specifically at Sonaca (Charleroi-Gosselies), whose civilian activities are almost completely tied to the evolution of this issue.

Early this year, the oversight council of Airbus Industrie, which consists, in different functions, of French, English, German, Spanish, Dutch and Belgian partners tied to the project, and which meets twice a year, noted that Airbus was primarily suffering from the formidable competition of Boeing, and that it was not able to hold its own against the American builder.

First general remark: the cost of the European airplanes turned out to be too high and far exceeded (from 90 to 230 million francs approximately) those of the immediate competitor.

Second finding, of a technical order: airplanes such as the A-300 and the A-310 (with whose construction Belgium is associated) cannot meet the increased performance of this same competition (greater flying range, greater pay load) in spite of improvements made on the basic models. Overall sales for the A-300 amounted to about 250 planes, but 40 of the 65 A-310 to be manufactured between now and the end of 1988 will remain unsold, according to the official forecasts of Airbus Industrie.

Added to those handicaps is the inability of Airbus Industrie to respond to the numerous orders for very short term delivery, orders which are met by the competition offering, at clearly lower costs, improved versions of older models (the M-D-80 and the B-737-300, for example). Airbus 320 suffers particularly from this situation -- firm sales are reaching a ceiling of barely 90 planes -- all the more so as its suggested claim of fuel consumption economy is being worn away by the spectacular drop of the dollar and of fuel

prices. Under those circumstances, the production plan foresees the assembly of only 10 planes in 1987, of 29 the next year and of 57 in 1989.

European Decision?

Having stated this finding, the oversight council of Airbus Industrie expressed the opinion that the entire project would not be able to survive beyond 1990 based on the A-320 program alone; it will be imperative for a new generation of planes (A-330 and A-340) to take over in order to provide potential clients with competitive standards of loads and ranges. But, in order to be able to introduce those big carriers on the market by 1991, the European partners will have to make a decision as early as this year and rely on data containing so many unknowns. Technical data, of course, but also an agreement in principle by the governments involved about the financing of the program, and the assurance of a certain number of orders which would assure the right start for financing. In this respect there has been talk of orders for both versions, originating with at least five airline companies which represent the market at a world scale. As for the financing of the program, one should note that while the council of Airbus Industrie has authorized spending 1.61 billion Belgian francs to cover preliminary expenses, a first estimate of the development costs has reached the breathtaking amount of 121 billion francs. This amount should be divided among the partners, Belgium having expressed its intention to intervene at the rate of 4 percent, as against approximately 2 percent in the A-310 and A-320 programs. Another element which is likely to influence decisions at this level: those same partners -- with the exception of the Belgians and the Dutch, who are simply "associated" -- will be called upon to cover, at a parallel level and in proportion to their involvement, the losses incurred during the fiscal years 1984 to 1988, estimated at some 55 billion francs according to the forecasts.

Difficult Hurdle for Sonaca

It may well be within this tight framework that the fate of Sonaca is being played out in Charleroi; Sonaca collaborates in the construction of the A-310 -- it manufactures the leading edge of the wings -- and is getting ready to extend this collaboration at the level of the A-320. One should note on this subject that the enterprise employs 857 wage earners and 486 salaried officials and that 60 percent of its work schedule (480,000 of the 800,000 hours of annual labor) is reserved for civilian activities, that is to say nearly exclusively for those Airbus projects which are at a virtual standstill. Hence a technical unemployment of more than 20 percent which had to be introduced permanently at the level of the wage earners. To cap it all: the military F-16 program is also slowly coming to an end -- it will end at the latest in 12 to 18 months -- and the project to build 44 helicopters is said to be no longer even among the priorities defined by the Ministry of National Defense. In that context, the fate of Sonaca seems precarious, if not perilous in the medium term,and could be at the root of very sharp tensions in the Charleroi basin.

8463
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EUROPEAN WORK ON OPTICAL COMPUTER CONCEPT OUTLINED

Paris SCIENCES ET AVENIR in French Feb 86 pp 72-78

[Excerpts] Computers are smothering under the weight of computations. The remedy--a daring idea: replacing electric current by beams of light. Optical components that work in picoseconds (1 thousandth of 1 billionth of a second) have already been developed under laboratory conditions. But the optical computer is still a long-range prospect.

As for Europe, it is not resting. Although its financial means are more limited, it nevertheless has one of the most advanced teams, that of Professor Desmond Smith at Heriot-Watt University in Edinburgh. The team's work on bistable optics makes them authorities on the subject, to the point that they are among the first European participants in the American "Star Wars" project. The Department of Defense has approved a contract for $150,000 to carry the results of its technological research to the marketing stage. This year, around this team was assembled the EJOB program (European Joint Bistability Project), which joins 19 research centers, 2 of which are French (Louis-Pasteur University of Strasbourg and the Fundamental Electronics Institute at Orsay). With a budget of approximately 13 million francs starting next year, EJOB plans to be in a position to examine the feasibility of an optical processor.

This general survey certainly demonstrates the excitement felt by the international scientific community with regard to the optical computer. Nevertheless, let there be no delusions; the difficulties to be overcome have caused many experts to be unsure about the near future of this revolutionary technology.

In the first place, the development of transphasors, the optical equivalents of transistors, is far from being mastered. The materials used are most often operational in liquid nitrogen at 77 degrees K. Only recently has it become possible to manufacture optical circuits which are operational at ambient temperature, by using the principle of multiple quantal wells (see box p 78) in an alloy of gallium arsenide-aluminum-gallium arsenide (AsGaAlAsGa). Andre Mysyrowiez and Daniel Hulin, working at the applied optics laboratory of the School of Advanced Technology (ENSTA), associated with the Polytechnical School, have thus obtained a logic element switching in less than one picosecond (a thousandth of a billionth of a second), at ambient temperature. However, the execution of such a material is quite a feat. It is, in fact, composed of several hundred layers of extremely thin gallium arsenide (53 A) alternated with

56 A layers of an alloy of aluminum and gallium arsenide. The difficulty of the endeavor can be appreciated by noting that the thickness of the layers must remain constant to within one electron shell.

Next is the problem of the integration on the same substrate of a large number of optical components. Currently an LSI (large scale integration) type scale is planned, which was achieved with integrated electronic circuits in the 1960's. Even if questions of cost are academic, it is still far from being achieved. Another important technological difficulty is that optical components consume large amounts of energy. Currently a bistable requires several milliwatts to switch. A computer combining tens of thousands of transphasors would require an enormous amount of power in watts per second. One solution consists of accepting a decrease in the speed of execution to limit the power required. Although the advantage of the extremely brief switching time of the transphasors is lost, all the advantages of optic components relating to parallelism are conserved. Furthermore, researchers believe that the future of optics lies primarily in massive parallel architecture rather than in speed alone. In any case, the architecture for electronic circuits cannot be copied using optical components. It is necessary to take full advantage of the specificities of transphasors, particularly their ability to have two stable states available, to invent radically new logical organizations. Despite all these obstacles, current research may result in short-term industrial applications. This is the case especially for optical interconnections which are planned for use in gallium arsenide integrated circuits, in machines with a high degree of parallelism, or in integrated circuits at the level of a semiconductor wafer (wafer scale integration). In addition, integrated optical circuits, even on a modest scale, have a wide range of applications in telecommunications, repeaters, and detectors where information is already being transported in luminous form along optical fibers. The National Center for Telecommunications Studies (CNET), quite active in this area, has just awarded its annual prize to Alain Carenco's group, who perfected a light wave modulation device for optical fiber transmissions which requires an extremely low control voltage.

Finally, research on optical components (optic valves, spatial modulators) may give a new lease on life to analog optical processors, particularly for the processing of side-looking radar signals. On the other hand, a completely optical computer, if it exists some day, can be planned only over the long term. Microelectronics has not ceased to exceed its limits of performance. Thus, at a congress organized in Tucson by Hyatt Gibbs in December 1985, John Armstrong, vice president of IBM and director of research at the Thomas J. Waston Center, presented the outlook for integrated circuits 10 years hence. By using three-dimensional structures, he said, it may be possible to obtain switching times on the order of 100 picoseconds in silicon circuits, resulting in transistors 10 times more rapid than current available components. This announcement posed a serious challenge to an audience composed of the foremost researchers on optic bistability.

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SAAB-SCANIA PASSENGER CAR PLANT HIGHLY AUTOMATED

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 11 MAR 1986 p 5

[Article by Sha: "Cavity Sealing in Only One and a Half to Two Minutes: Extensive Automation in the Trollhaettan Saab-Scania Passenger Car Plant"]

[Text] Frankfurt. Today automobile cavities are generally sealed using nozzles which have been specially designed for this purpose. Even the introduction of galvanized sheet metal has not changed the need for cavity sealing. Consequently Porsche, for instance, is still using an Atlas-Copco-patented process to apply a rust-protection medium to body cavities. Recent research efforts have been aimed at increasing the degree of process mechanization, ensuring uniform quality, and improving inspection. Increased mechanization has the advantage that the rust-protection material is sprayed at a higher temperature, which makes it possible to conserve on solvent.

An Atlas Copco cavity sealer unit features automatic operations at its primary stations and is currently achieving cycle times of 1.5 to 2 minutes, depending upon the complexity of the nozzles and/or the spray bridge movements. The only way it would be possible to achieve additional cycle time reductions would require accelerating positioning procedures and nozzle movements, as well as cutting times through more intensive computer utilization. For the time being, totally automated cavity sealing units will remain a pipe dream. Nonetheless, procedures can still be refined.

The Saab-Scania Passenger Car Plant in Trollhaettan northeast of Goteberg has installed a cavity sealing line 50 meters long, on which between 180 and 200 injection operations can be carried out, and which has a capacity for 120,000 passenger cars per year. The turnkey facility includes a complete system: from the pump room with its mixing tanks and vacuum recirculating pumps to specially designed spray bridges with nozzles. The pump room includes four large mixing tanks, from which the rust protection material is directed to the dosing pumps on the wall of the spray cabinet. The rust protection material is pumped from three tanks, each with 10 cubic meters capacity, into a circuit network with an overall length of 500 meters. An auxiliary tank with one cubic meter capacity and its own distribution system is used for testing sample materials.

The material passes in a continuous circuit from the dosing pumps via the heater, which maintains a constant temperature of 40 °C, to the spray bridges. This "hot circuit," during which the rust protection material is constantly filtered, is an essential feature of this system design. As soon as the spray cycle starts, material circulation stops and the dosing pumps, which work at

a material pressure of about 100 bar, release a precisely dosed amount of material to each nozzle.

The entire treatment process is divided up among seven different spray stations. In the first three stations the nozzles, which feature magnetic positioning plates (Atlas-Copco patent), are manually applied. When all the nozzles are in their correct positions, the operator pushes the start button and the spray cycle begins. The only cavities that are treated manually in this fashion involve inaccessible parts of the compartment and the trunk.

Finally at the fourth station full automation takes over. This cycle begins with positioning the body. It's position is adjusted accurately down to the exact millimeter and fixed in position. The hood is lifted automatically and the large automatic spray unit is moved into the engine compartment. The system itself checks to make certain that both the automatic equipment and the body are in the correct position. If this is the case, the spray cycle begins. Treatment time at this station lasts about 1.5 minutes. This is enough time to treat a total of 45 injection points in the body automatically with rust protection material.

At the fifth station, a series of fully automatic spray procedures are conducted on various parts of the body. The cycle begins by lifting and fixing the position of the body. Then all the spray bridges move into spraying position. For instance, the mud flaps are sprayed automatically by mobile, automatic units which have four nozzles each and swivel 180°. All the work cycles at this station are controlled by the microprocessors in the central control unit.

The doors are also handled automatically in the fifth station. When the body has assumed the correct programmed position, the special door openers open all the doors. Then four automatic door units rise from the floor, each one fixes the position of one of the doors, and introduces four spray nozzles into the cavity. During treatment--monitored by the electrical unit control system--the nozzles rotate to provide rapid, effective and complete rust protection to the door cavity. Then the automatic units return to their initial position and the doors are shut again. Touch-ups, if any are required, are carried out at the sixth station, but actually most bodies pass right on through. Finally, station seven is an inspection station at which the entire vehicle is inspected for rust protection.

The total unit is monitored and controlled by a computer. The operator can observe and monitor the entire process from the central control console. Sensors register whether the spray nozzles are working or not. If any kind of error occurs, a signal lights up at once, simultaneously locating the malfunction. The operator also has the possibility of int erupting the automatic cycle and taking over manual control of the spray bridges. This way individual components in the unit can be tested and inspected manually if need be. Since it would be expensive to shut down the unit, the supply system includes back-up features. This holds true for the material filter and the pumps as well, including the pressure flow gages. The facility switches over to the stand-by system automatically if pressure drops off.

13127
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COMPOSITION OF ITALIAN ROBOTICS INDUSTRY

Turin MEDIA DUEMILA in Italian No 13, Jan 86 pp 13-15

[Article by Mariangela Pattarozzi: "Comau and Sigma, Robots Marching to America;" first paragraph is MEDIA DUEMILA introduction]

[Excerpts] Italy's offering of robots cannot be defined in terms of "classic competition" based on a single market of replaceable products. It is a system of specific sub-markets, defined by the characteristics of each robot, where each firm finds itself competing with only a few rivals. This supply covers all the principal fields of activities from traditional welding, painting and handling to recent, more sophisticated techniques such as assembly, measuring and laser-cutting. A characteristic of robotics production in Italy is that of a small company working with high technology. The average number of employees is about 50, a number which small firms have in common with the robotics division of medium/large firms which have diversified their activities in this field. Organization and technology account for the small-size enterprise: Most small firms dedicate themselves to the designing and assembling of robots rather than to complete A-Z construction. Because of the low standardization level of the product as a whole, this industry still retains many characteristics of applied research, the purpose of which is to adapt robots to the needs of a single nucleus of users, thus necessitating flexible and uncomplicated business structures.

One-third of robot producers are located in the province of Turin, over 50 percent in the Lombardy region and 2 in the Emilia-Romagna region. These firms rapidly multiplied on the borders of the large industrial areas of the north, like Turin, Milan, Varese, Pavia, Cremona, Piacenza and Bologna, which highlights the importance of pre-existing technical environments for the birth of new sectors. In this respect, particular reference is made to Turin's science park and the concentration of machine tools in Lombardy.

These are the genetic and structural characteristics which determined the development of robotics in Italy during the seventies. Even so, during the 1980's, there are robot producers who will be obliged to face the challenge launched by colossal multinationals in world production, which are entering the "automated factory" market with increasing resolution. The two most important "Made in Italy" robotics companies are Comau and OCN, divisions of the leading Italian industrial groups Fiat and Olivetti.

During the last 50 years, Comau (still referred to by its original name of "II" Comau, standing for Machine Tools Union), developed production structures and acquired professional experience in the Turin and Modena areas and in 1977 became an incorporated company. Comau is the industrial automation company of the Fiat group and, with it 5 factories, 3,144 employees (25 percent of which are dedicated to research and development), and 404 billion lire turnover for 1984, is the leading Italian company in the industrial automation sector and holds fifth place in world production--with two-thirds of its orders consisting of exports.

Right from the start, Comau chose the integrated system market rather than that of single robots. Consequently, in recent years, this Turin company has developed large flexible systems, automated welding lines, assembly plants, computerized warehouses and testing lines. Comau's point-welding line, used in the production of the "Uno" automobile, is world famous; as is the recent production of an assembly line for "Fire 1000" engines which Comau developed for the Fiat factory in Termoli and which produces an engine every twenty seconds.

Apart from these two large private concerns, there are three huge public companies operating in the robotics market: DEA of Moncalieri, purchased by the Stet group (IRI) Elsag; Ansaldo Elettronica (Finmeccanica); and Sapri, automation division of Savio di Imola of the ENI group which produces robots in collaboration with Prima Progetti of Turin.

The DEA (Digital Electronic Automation) was founded in Moncalieri in 1962 through the initiative of two engineers, F. Sartorio and G. Minucciano (coming from Fiat where they had worked on analog computers), and L. Lazzaroni--partner and financier who imported the first "flippers" and jukeboxes to Italy. The idea was to produce something in the field of digital electronics. Within the space of a few years, DEA produced an automatic measuring robot which represented an innovation on a worldwide scale. Toward the end of the 1970's, available internal know-how led DEA to diversify itself in the production of assembly robots, since this technology is more closely related to measuring robots. Thus, production of measuring robots began in 1982. DEA, with a staff of 780 people of which 160 are dedicated to robot production, produced 70 machines in 1984, assembly and measuring robots mostly destined for foreign markets, for a value of over 13 billion lire. Having been taken over by public ownership, DEA is now reviewing its production philosophy which regards the robot as a component of the most sophisticated flexible production systems. The abandonment of DEA by one of its founders, F. Sartorio, was symbolic of that technical entrepreneurship which has already emerged as an inherent element of Italian robotics. Sartorio, stimulated by his desire to produce something of his own, founded the Prima Progetti company in Moncalieri in 1977. This company, which belongs to the Prima Industrie group, is a strong element in skilled and sophisticated Italian robotics and produces handling, arc-welding, measuring and laser-cutting robots.

Further example of entrepreneurship are the companies Jobs in Piacenza and Camel in Palazzolo Milanese. Jobs was founded in 1979 by two engineers

who came from Mandelli, a major Italian firm in high technology machine tools. Acquired mechanical and electronic competence permitted JOBS to single out its own specialization area: "slave" robots for machine tools. Jobs, with 23 robots sold in 1984 for 2.5 billion lire, is now a leader in the Italian flexible automation market.

Camel was founded in 1984 by two technicians, previously engaged in industrial automation research work, who began thinking of robot production in the early 1970's as a result of positive signs on the American Market and their own accumulated technological know-how. Not finding space for the development of their ideas in the companies where they worked, they left their jobs and created Camel out of practically nothing. After the first two robots produced for Lagostina and Alfa-Romeo, Camel's take off was confirmed by an order for the automation of Candy's basket-tank assembly lines. Camel has therefore become one of the most renowned robot producers in Italy today. In 1984, Camel built 25 handling robots and had sales of 2.7 billion lire. If Italy constructs robots and holds a prestigious position on the international market, it is not only due to the merit of these companies, but also to the merit of tiny firms which, with limited means and unlimited ideas, ventured into the robotic market in response to the growing demand for technology on the part of industry. In this respect, reference must be made to the following firms. In the robot painting sector: SIS in Gazzada (Varese) and Gaiotto in Vaiano Cremasco (Cremona); in the welding sector: Bisiach & Carru in Torino; in the measuring sector: Meccanica Speroni in Spessa Po (Pavia).

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FACTORY AUTOMATION

OLIVETTI'S INDUSTRIAL DIVISIONS PROFILED

Turin MEDIA DUEMILA in Italian No 13, Jan 85 pp 83-5

[Article: "Objective: Automation For the Four Olivettis"]

[Excerpts] The industrial Goods Division of the Olivetti Group has been operating in industrial automation since 1926. Work centers, numerical control lathes, gauging machines, assembly robots, command units with numerical control and computers are the milestones in Olivetti's activity, to which the group has dedicated its resources and in which it has distinguished itself throught the development and renovation of technologically advanced products; thus earning itself a position of primary importance in the field. Olivetti has at its disposal an immense range of complementary products capable of integration: from work stations to CAD-CAM systems and automatic warehouses. The company is not only in a position to mobilize the group's massive resources (most of which are already occupied in solving similar problems in other fields), but is also able to activate a series of alliances and agreements aimed at the completion and consolidation of the complex know-how that is indispensable for advanced development.

The Industrial Goods Division is composed of four companies: OCN, OCN Sistemi, Osai A-B, and Epp-Ppl. Each has different specializations, but are all integrated and contribute together to the design, production, marketing and maintenance assistance of a complete range of apparatus for the automation of exceedingly varied types of products. Alliances and international agreements have been stipulated to strengthen the group's competitiveness: the joint venture between the United States' Allen Bradley and Osai A-B for product and market growth, recently joined by the agreement with Japan's Nippondenso for distribution of Italian products in the Orient and the exchange of technology; the Epp-Ppl/Lodge & Shipley agreement for lathe automation in the United States; the OCN/Prime Industrie alliance for measurement-robots.

To this should be added the collaboration present within the Olivetti Group itself: software firms (more than 25), CAD-CAM and automatic testing firms. Not to mention the huge potential represented by direct access to the progress of personal minicomputers, projected and manufactured by Olivetti. In the group's internal strategy, the role of the Industrial Goods Division is that of supplying modular and progressive solutions for

automation in assembly and mechanical work leading to complex integrated solutions, to test and apply Olivetti EDP products in the industrial environment and to introduce industrial automation into the Olivetti Group's own organization.

The results of the automation sector are positive. A consolidated turnover of about 130 billion lire in 1984 gave a 30 percent increase over the previous year. The first 6 months of 1985 reflected a further improvement of 15 percent as opposed to the same period during the previous year. Following is a description of the 4 companies:

OCN

One of Europe's major companies in the field of Industrial Goods and high technology; OCN designs, produces, sells and supplies maintenance manufacturing service centers with vertical and horizontal mandrels, measurement machines and mechanical modules for automation. Conceived for convenient use in flexible systems, all products sold at present offer besides traditional high precision and sturdiness--a high degree of modularity and automation. From 1963 to the present time, OCN has installed over 2,500 manufacturing centers and more than 1,500 gauging machines. Apart from collaboration with "Prime Industries," OCN has added seven new models to the existing lines.

Epp-Ppl

Epp-Ppl is a company which designs, produces and supplies maintenance service for numerical control lathes and covers the full range of small, medium, horizontal and vertical lathes--all of which can be fitted with the most complete services available on the market. From 1979 to the present time, Epp-Ppl has installed nearly 3,000 NC lathes. In Italy, the company occupies a leading position with a 30 percent quota of the market. Sales are aimed at the western European market by means of a network of agents, while commercial penetration in the United States is assured through the Lodge & Shipley contract.

Osai A-B

Specialists in the production of numerical control systems for machine tools, robots and gauging machines. Founded in 1976, it became a joint venture in 1982 between Olivetti and the Allen Bradley Corporation, one of the leading companies on the American industrial automation market. Osai A-B combines the technology and the experience of the two companies which have taken third place on the international market and which since the beginning of numerical control production, design, produce and sell control systems for machine tools. Osai A-B also avails itself of all the electronic Know-how which the Olivetti Group has to offer. It markets its own products throughout Europe and a series of international agreements take care of export and maintenance services in North America, Japan and other countries in Asia. A system which means a significant world-wide outlet for Italian technology, in full accordance with the Olivetti Group's most deeply-rooted traditions.

OCN Sistems

The youngest of the Olivetti Industrial Goods family. The birth of this company in 1983 was a specific response to emerging tendencies in industrial automation--briefly, the "factory automation" in its most integrated form. This is precisely the purpose of its existence as an engineering company, which is aware of and acquires the market's basic components, so as to project the connections and create a greater system. The main requirements for success in an engineering company are the association of mechanical and electronical competence; methodical rationalism in gathering users' demands and rechanneling them into linear solutions; an organization capable of directing and managing large orders. This company is the meeting point for software, special mechanical apparatus, numerical control standards, command units, computers etc., coming from the Olivetti Group's companies and from other manufacturers. OCN Sistems has produced 150 different applications for the assembly sector and 5 highly complex FMS.

These strengths and opportunities give the Industrial Goods Division a clear and global view of the evolution of industrial automation thereby providing it with new products and technology which Olivetti is continuously developing and renovating: computers, connecting interfaces, intelligent terminals, software, CAD-CAM. Olivetti is the only company possessing its own means and know-how for the supply and guarantee of flexible automation and utilizing the latter for its own production: the Olivetti factory in Scarmagno (400,000 minicomputers per year) is an example on a worldwide scale.

[Box, p 85] Osai A-B, a firm in the Olivetti Group's Producer Goods Division and specialized in command units for numerical control machine tools and robots, has signed two separate contracts aimed at the marketing of its numerical controls on the American and Japanese markets. Osai A-B's numerical control series "8600," are destined to be an integrated part of the new, high-automation production plants (FMS) which Caterpillar Tractor is in the process of developing in the United States. The contract involves European, American and Japanese constructors of machine tools, amongst which the name of Toyoda is prominent. The latter will install Osai A-B systems in their machining centers and lathes, which are to be used by Caterpillar.

On the Japanese market, an agreement has been reached with A-B Nippondenso, a company jointly owned by the American Allen Bradley and the Japanese Nippondenso (automobile components, 6 thousand billion lire turnover in 1984). The agreement provides for the exclusive distribution rights and assistance in Japan for Osai A-B's 8600 systems. Osai A-B products will subsequently be produced in Japan under license.

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FACTORY AUTOMATION

BRIEFS

ROBOT SYSTEMS TO FRG AUTO FIRMS--The main German representatives of the automobile industry have purchased robot systems for body testing from DEA of the Selenia Elsag Group, which is based in Turin. The overall value of the work orders issued by Audi, BMW, Daimler Benz, Volkswagen, and Porsche is about 10 billion lire. The ordered robots all belong to the Bravo family, which has recently been revised and completed by the robots of the Diamond series. The Bravo robots apply advanced technologies with regard to both mechanical structure and numerical controls. Because of this, they are able to detect machine shop rejections and also to prevent the production of imperfect parts, giving immediate information to improve the production process. The main characteristics of the Diamond set are the high operating speed and the high measurement precision. Moreover, the robot has been designed to accept automataic storing of measurement tools as well as feeding devices for parts of the structure itself. At present, work orders to be executed by DEA, which produces measurement and assembly robots, measurement coordination machines and control systems for industrial logistical equipment, totals about 77 billion lire. [Text] [Milan AUTOMAZIONE OGGI in Italian No 14, p 20] 8609/9871

EUROPEAN MAP USER GROUP--The companies Volkswagen and Siemens have already decided to cooperate in a European working group of users of programmable devices for the automation of processes and production sequences. The working group which calls itself European Map User Group (Emug) wants to develop standardized interfaces in order to make possible the integration of individual machines with the goal of making the automatic "factory of the future" a reality. The European working group Emug sees itself as a counterweight to the Manufacturing Automation Protocol (Map) working staff, established as early as 1980 at General Motors, which deals with the lack of communication among the intelligent devices in the factory halls. At present, General Motors has more than 40,000 programmable devices in use, of which only 15 percent can exchange information. Communication accounts for 40 to 50 percent of the cost of automation today. To avoid falling behind the United States in the standardization of intelligent manufacturing systems, there are at present as many as 40 European user firms which have decided to participate in the European working group. By the end of the year, 160 firms are expected to participate, among them additional companies from the FRG. Anthony J. Scarr, secretary of the European Map User Group made this assumption recently at an information meeting in Frankfurt. According to Scarr, deliveries of machines to the United States require adherence to the American Map standard already today. [Excerpt] [Frankfurt/Main FRANKFURTER ALLGEMEINE ZEITUNG in German 7 Oct 85 p 13]
CSO: 3698/141

MICROELECTRONICS

NEW FRAUNHOFER INSTITUTE FOR MICROSTRUCTURE TECHNOLOGY IN FRG

Frankfurt/Main FRANKFURTER ALLGEMEINE ZEITUNG in German 24 Oct 85 p 17

[Article by GM: "Expose Chips with X-Rays-- The Fraunhofer Society Establishes Institute for Microstructure Technology"]

[Text] Munich. New generations of electronic components are reaching the market at ever increasing speeds. Soon, megabit memories will be available in the area of VLSI circuits, possibly four megabits will be a reality before the end of the decade. In addition, research and development are already aiming at 16 and 64 megabit chips which could become ready for use in the first part of the nineties.

By now the structures of microelectronics have become so small that in further development it will no longer be possible to project them on silicon wavers using light beams as is done presently. The wave length of light sets a limit. Therefore, in just a few years computer chips are expected to be "exposed" by x-rays which have a considerably shorter wavelength. In the United States and Japan intensive work is being done in the field of x-ray lithography.

Against this background the senate of the Fraunhofer Society decided at its annual meeting in Munich in 1985 to change the present Berlin research division to a "Fraunhofer Institute for Microstructure Technology" at the beginning of 1986. As early as 1982, the Fraunhofer Society started in Berlin to develop the technology of x-ray lithography which is supposed to allow circuit structures of less than one micrometer. By now, approximately 50 staff members of the Fraunhofer Society do research in this future technology they are sponsored primarily by the Federal Minister for Research and Technology and work in close cooperation with the German electronics industry. So far, more than DM 60 million have been spent on new construction and equipment. During further expansion the staff of this Fraunhofer Institute which has the task of developing the future production technology of microelectronics to an industry-ready level is to be increased to 80 within a short period. Professor Anton Heuberger who is currently head of the research division as well as a full professor at the Technical University of Berlin with the chair for VLSI circuit technology will be chief of the institute.

The planned new institute is only one example of the increasing tasks of the Fraunhofer Society which conducts applied research and development in the fields of natural and engineering science. The society plans to increase its staff from 2,824 last year to 3,440 in 1989. By then, expenditures are expected to easily exceed DM 500 million; in 1984 expenditures amounted to DM 361 million (F.A.Z. 9 Oct). The increased requirements will be due not only to the establishment of new institutes--which is offset by the occasional closing or scaling-down of other institutes--but also by the expansion of recently established institutes. The Fraunhofer Society feels that for an economical operating size a staff of 70 to 100 persons per institute is necessary. Not all institutes have reached this figure yet.

The Fraunhofer Society pays close attention to the research and technology policy of the European Community. In this context undersecretary Rudolf Sprung who represented Federal Minister for Economics Bangemann at the annual meeting considers it a goal to use the large size of the common market for research and to strengthen the scientific and technical cooperation of firms and research institutes. Here, the federal government emphasized two points: The research policy must be guided by the principles of a free enterprise economy; EC-research should not be limited to EC-financing of national projects but should bring an additional benefit for the community by sponsoring research across borders. The Eureka initiative is expected to provide a stimulus in this direction. Here, the Federal Republic has in mind large-scale projects in information and communications technology, robot technology, materials, manufacturing technology, biotechnology, marine technology, laser technology as well as the advanced technologies for environmental protection and traffic. Within the framework of an efficient coordination of national research policies which must be the goal Spring considers it particularly urgent to reach an early EC agreement on development plans for infrastructure projects in the area of telecommunications.

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SCIENTIFIC AND INDUSTRIAL POLICY

EFTA, EC SEEK CLOSER COOPERATION ON RESEARCH PROGRAMS

Vienna DIE PRESSE in German 9 Jan 86 p 7

[Report by Margarete Freisinger, datelined Brussels, date not given: "EC Emphasizes Research, Vienna Aims for Technology Agreement]

[Text] So as to catch up in technology with the United States and Japan, the EC is now emphasizing research activities. It also intends in future to involve the EFTA countries also to a much greater extent. Switzerland, Sweden, Finland and Norway have already negotiated skeleton agreements on research policy, and a similar treaty with Austria is in preparation. However, if Austria wishes to benefit from this technological cooperation, the money spent on research will have to be substantially increased.

The now incipient closer cooperation between EC and EFTA in the field of research and development had been decided upon as far back as April 1984 as per the statement issued at Luxembourg by the foreign and economics ministers of the (then) ten EC and seven EFTA countries. The EFTA countries expected thereby to safeguard their contacts with European technological development, the EC countries a diminution in their technological backwardness by comparison with the United States and Japan.

The Luxembourg summit of heads of government, held in early December, demonstrated the importance assigned this issue. The Community there solemnly subscribed to the concept of a comprehensive technological community. The heads of government also and expressly mentioned cooperation with third countries so as to achieve this objective. It is likely that the increased EC research activities were greatly stimulated by the current European high technology program "Eureka." Eighteen countries, including Austria, are involved in this.

Up to now the EC Commission's research budget amounted to roughly 10 billion schillings per annum, 2 percent of the civilian research spending of the (then) 10 member countries. The four EC research laboratories in Ispra (Italy), Karlsruhe (FRG), Gael (Belgium) and Batton (Netherlands) have been allocated 10.5 billion schillings for a period of 4 years. So far, the EC countries spent two thirds to three quarters of U.S.research expenditure but twice as much as Japan. However, due to its fragmentation, the efficiency of this single country research was relatively poor.

Cooperation appears imperative in many fields of research which cannot be confined within national borders, such as environmental control and transportation, or which--like medicine, telecommunications and large-scale computers--require bigger markets.

Some EFTA countries have long been involved in EC research programs. The skeleton treaty on research and technology to be imminently concluded at government level between the EC and Austria will now afford extensive opportunities to our domestic industrial firms and research institutions for participation in research projects as well as for the exchange of scientists. The Esprit Program, for example (information technology) is to be open to EFTA countries from 1987 on. Much the same applies to the Race and Brite programs (telecommunications and industrial technologies).

Separate contracts need to be concluded for each area of cooperation desired--for example environmental control, materials or biotechnology research. In the case of individual projects, firms must participate in the bidding, then independently carry on research and exchange results. As a rule the EC pays half the costs of such projects, the commercial firms must find the rest of the money themselves. This implies a decidedly larger allocation of money to research in Austria.

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CSO: 3698/261

SCIENCE AND INDUSTRY POLICY

EC OFFERS EFTA COLLABORATION PROSPECT IN ESPRIT, RACE

Helsinki UUSI SUOMI in Finnish 7 Mar 86 p 25

[Text] EC information technology and telecommunications chief Michel Carpentier urges Finnish firms to actively seek collaboration with EC associates in the field of the EC's own technology programs too.

According to Carpentier, the EC intends to gradually open big EC technology programs like Esprit and Race, which are supervised by a strategy team headed by Carpentier, to firms in the EFTA countries too. EFTA firms will be admitted to the Esprit program no later than the second phase of the program, which will be initiated early next year. So, it is getting to be urgent to send out feelers to engage in collaboration.

Finland is at present negotiating a general agreement on technical research and technology with the EC which EFTA countries Sweden and Switzerland have already signed. Carpentier does not feel that the general agreement is a precondition for admission to the technology programs, but that projected agreements primarily represent the EC's political determination to expand technical collaboration in many different ways.

Visiting here at the invitation of Finnish industry, Carpentier heads the EC information technology and telecommunications strategy team in Brussels. He is known as the initiator of the Esprit information technology and Race telecommunications programs.

There are, for example, a total of 170 projects in the approximately 7.5-billion-Finnish-markka Esprit program, launched in 1983. There is an average of five participants, firms and research institutes, in each program. The EC pays about half the expenses of the program.

In the future as well, the final power to make decisions will remain in the hands of the EC Commission. Carpentier, nevertheless, assured us that there is now a great desire to engage in collaboration so that Europe's industrial structure, its at-present shattered markets and the general business climate can be developed on a pan-European basis to meet the challenge represented by the Americans and the Japanese.

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CSO: 3698/365

SCIENTIFIC AND INDUSTRIAL POLICY

DETAILS ON EC 1984-1987 RESEARCH BUDGET

Copenhagen BØRSENS NYHEDSMAGASIN in Danish 10 Feb 86 p 23

[Article by Tor Nørretranders in "Research" section: "EC Staking 30 Billion Kroner on Research"]

[Text] Research programs in 1984-87 encompass a budget sum of 30 billion 1982 kroner. Industry-directed research and research on energy are the biggest receivers of the research money.

EC has begun to carry on research seriously. In the years 1984-1987 it is the intent that 3.75 billion 1982 ECU's, which is the equivalent of 30 billion 1982 kroner, are to be used on research and development. However, money has been appropriated only for part of this budget program, which was passed in 1983.

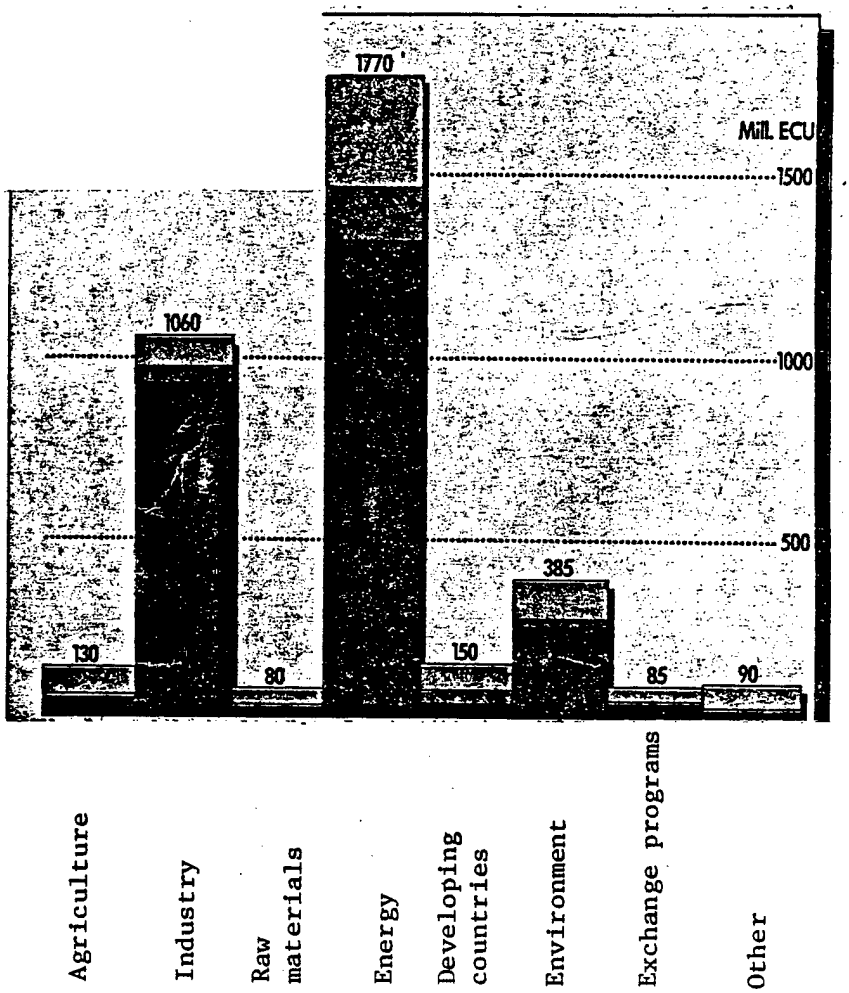
In spite of this big money, EC's research program cannot be described as a success in advance--indicated most distinctly via the enthusiasm for the French Eureka initiative, which has attracted far greater attention, although no one can put figures on the program's size or just render it probable that it will be the size of the budget program of 30 billion 1982 kroner. The Eureka idea's media and politician appeal is rather to be understood in light of the fact that Eureka is completely free of the Eurocratic features which have strained EC's budget program.

The budget program can be divided into eight major areas of intensely different sizes, as can be seen from the accompanying chart.

The first group is agricultural and fisheries research, which EC itself characterizes as "far less than what European agriculture and fishing really need." This group constitutes 3.5 percent of the total budget, but the figure is misleading, because only a small part of the budgeted amount has been in fact appropriated.

Industry-directed research constitutes the second largest group with 28 percent of the budget, the majority of which has been appropriated. The budgeted figure constitutes a good billion ECU's. A considerable part of this money is going to the ESPRIT program, which especially concerns data processing and microelectronics. Other, smaller, programs concern communications technology

(the RACE program), bioengineering, materials science (the BRITE program) and other industrial areas.



EC's Research: Budgeted Programs 1984-87 Divided by Sectors

Amounts in millions of ECU's at 1982 value; 1 ECU = 8 Danish kroner. Source: EC Commission

Raw materials are the subject of the third research group, which cannot be characterized as being of great size either as far as the budget figure or actual appropriations are concerned. It is subjects like waste recycling, uranium exploration and substitute materials for iron which belong to this little homogeneous group, which totals 2.1 percent of EC research.

On the other hand, energy research constitutes EC's all-dominating gamble. This group takes up 47.2 percent of EC's research. Nuclear power represents a small quarter of the money in this group. The main subject area is safety problems associated with this form of energy. A main item within energy research is fusion energy (the fusion of atomic nuclei, as takes place in the sun or hydrogen bombs). European research is coordinated here. This program is swallowing up nearly half of EC's energy research. Finally, there are smaller programs for research on renewable energy sources ("permanent forms of energy," as EC calls them) and energy conservation.

Research on developing countries has a small budget which has been filled by scanty actual appropriations. The budget constitutes four percent of EC research.

Environmental research, which EC calls research on "living and working conditions," constitutes 10.3 percent of the budget and encompasses problems in the working environment and outside environment.

Exchange programs constitute a group of activities which are aimed at what EC calls "strengthening of technical and scientific usefulness" and "the usefulness of research potential." Hiding behind these designations is a program which constitutes 2.3 percent of the EC budgeted amount. It concerns the exchange of research results between countries, the exchange of younger researchers, the establishment of "friendship laboratories," etc.

Finally, 2.4 percent of EC's research goes toward something which is described as "horizontal activities" (the designation "other" was chosen for the accompanying graph). This group encompasses the improvement of scientific educations and scientific communication.

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NEW HEAD OF FRG RESEARCH GROUP DFG ON FUNDING POLICIES

Munich SUEDDEUTSCHE ZEITUNG in German 17 Jan 86 p 10

[Article by Axel Hacke, member of editorial staff: "Persistent Pursuit of Variety"]

[Text] This book I am holding: How much might it weigh? Three pounds? It has almost 1,000 pages and is 4.6 cm thick. The postal scale I pressed into service promptly broke down. The fat tome lists names. Thousands and more thousands of names of German scientists plus the names of the projects they are working on: Ruth Mayer-Opificius and Tilman Eickhoff are busy in Berlin on a mystifying project named "kar tukulti minurta." Peter Zerwas in Aachen is dealing with the "Production of Top Quarks by Electron-Positron Collisions," Axel Zerdick and Manfred Knoche in Berlin with "Selection, Consonance and Focusing Effects of Press Reports on the 'Greens in the Bundestag' in the Long-Range Effect of Media Operations." Joachim Schoenherr in Freiburg called his opus "The Sexual Dimorphism and Taxonomy of Bark Beetles." Also listed, on page 676, is the research ship Meteor, its Captain Walter Feldmann and 57 crew members.

What, you may ask, is this book? The jacket tells us its name: "DFG Programs and Projects 1984." It is the list of all scientists and all scholarly investigations backed in 1984 by the resources of the German Research Community in Bonn. Though, after leafing through some pages of this giant book, the layman is entirely at a loss to understand what the persons recorded therein do with the money allocated them, he is bound to immediately appreciate the tremendous range and variety of that which is being promoted. If we could reduce to its essence the work of such a major organization(which is largely unknown to the general public), it would amount to precisely this: Each scholar is to be able to ask for backing for any scientifically justifiable project. The DFG is intent to encourage the variety of science.

Failures Also Occur

Hubert Markt, since 1 January successor to Eugen Seibold as DFG president, phrases it as follows: "The best research is that of an individual scholar at an individual desk. Its encouragement should not depend on a need that is ascertained somehow, instead it must focus on persons who want to do something. We are often asked why we back a doctoral candidate here, two scientific workers there--do you really have to do that? Yes, indeed, that is just how it must be. Ten years later we are overjoyed when well qualified

scientists have thereby become available. Of course failures also occur, but we must be allowed to back failures as long as the good ones get a chance to grow to excellence.

Considered from this standpoint, the DFG is better justified than most in its claim to have encouraged Nobelist Klaus von Klitzing on his way to success. Klitzing took his doctoral degree in 1972, within the framework of a DFG research project; the DFG financed him for a year's research in Oxford, and at the time he discovered the quantum sound effect in Grenoble, he had a grant from the DFG's Heisenberg program. As Markl says: "When Klitzing was still working on his dissertation, only something like the DFG would even look at him."

To take a closer look at this work, we visited for an hour with Walther Klofat in his office. Klofat looks after the biology 2 section at DFG head office in Bonn, a section concerned with genetic technology, among others. He himself describes his work as dealing with "the advanced regions of bioscientific research" as well as representing a "relay station between the fronts." Grant applications arrive at his desk, he hands them over to the ten experts competent to deal with his specialty. They are honorary, experienced and select scientists whose job it is to judge whether and to what extent the proposed projects are worthy of backing. Klofat deals with 300 applications each year, "I barely know how I manage." He also looks after 15 spewcial research subsections.

The most important consideration with regard to an office like this is that of finding out the kind of network of scholarly relations the DFG provides, how intimately it collaborates with all concerned, what opportunities arise for a case worker like Klofat to affect an entire branch of science in the FRG and in how far, therefore, the DFG is not just an anomymous intermediary but able under its own steam to affect the course of science. Very few people in Germany have as much of a complete overview of the particular field as Klofat, for example; few get to know the scientists involved while they still (to use his words) "feed rats and clean glasses" and later meet them again at congresses. He is therefore able to advise applicants, indeed many a project only picks up steam in his office. Finally, the various types of DFG aid are not isolated from one another. Someone who began with a minor project in the normal course of events may subsequently find himself involved in a "key project" and later yet in a special field of research. Klofat has learned that groups of researchers often tend to coalesce into "a core team of scientists who work well together." Not long ago, for example, a special research section grew out of such a group which was dealing with the "expression of the genome."

Doubts About Experts

Not everyone is ready to accept this attractive description. Many young scientists, for instance, criticize the competence of the experts. According to Klofat, it happens quite often that the people who submit projects also indicate the experts they consider suitable, alleging that those chosen by the DFG do not know anything about their special field. "I have a great deal of understanding for the concerns of these people who wish to have someone really comprehend what they are about to tackle." That is particularly applicable in

the case of a specialty such as gene technology which is developing so very rapidly.

Recourse is occasionally had to an outside expert opinion by a specialist or former expert in the particular field. Indeed, the problem can hardly be settled in any other manner. After all, this is where we are touching upon one of the preeminent principles of the DFG, namely that the money for research is to be distributed by the researchers themselves, according to a clearly stated procedure. The DFG has therefore sometimes been called a "republic of scholars," and the large extent of self-administration implicit in this principle is suddenly expressed by Hubert Markl in a peculiar mixture of high flown language and bureaucratese: "We are enjoying a truly heavenly freedom of allocation. We should really thank the government for giving us the freedom to make well founded switching decisions." Whether to spend money on humanities research or on a project in biological sciences, whether it is better to study the labor policies of Japanese firms or changes in the membership structure of Berlin's SPD--the scholars themselves are best equipped to decide, and they are doing precisely that in the DFG committees.

At the same time it must be admitted that this DFG independence, much praised as exemplary in other countries, is by no means unendangered. Markl considers its preservation one of his most important tasks in the coming years. When the DFG members elected him their new president last year, they may have thought it well to entrust the job to a younger man. Markl is 47, was born in Regensburg and studied in Munich. Since 1974 he has been full professor of biology in Constance and is a man of impressive eloquence, a genuine artist of the lecture room who is able by talking of "evolution and gene technology" to arouse the full-throated enthusiasm of his colleagues--he is certainly no unworldly scholar.

The DFG has some problems in coping with the rising numbers of grant programs it has lately been asked to handle. Though this money, too, is available for research, it cannot be spent within the framework of DFG procedures but only on objectives prescribed by the government. Post doctoral programs, top research programs, ocean drilling program, information engineering program, continental underground construction program--in the old days about DM20 million were available for such purpose, while the amounts involved now range from DM50-70 million. This actually runs counter to DFG principles, and Markl has the following comment: "We would be very glad if it were the general opinion that the DFG does its own thing very well, so let us give it total freedom. I would not like it much if these special assignments were to run riot."

Does the DFG's excellent reputation have some drawbacks, too? Markl says it also means "that everybody wishing to spend money for some good purpose turns to our experts for their advice. This confronts the DFG with a difficult situation: We have up to now been an association for the appropriate distribution of money. Once the DFG gives expert opinions on everything under the sun, we might end up as a branch of the government's executive apparatus and, therefore, subordinated to it." In that case, any applicant must stop to consider whom else the experts are working for--the DFG's independence would soon be lost. That is why, Markl notes, "we do not wish to extend our

authority. We simply must be able to say: Thank heavens, there are also others."

In any case, the DFG regards as its traditional task the necessity to withstand the fatal inclinations of many politicians. Many of these would like to decide where and what kind of research should be carried on, expressing their preferences in well equipped programs. By contrast the DFG must exercise vigilance and remain conscious of the fact that undirected and uncontrollable basic research is the foundation of all science. Markl therefore considers it "undesirable for the general public to become accustomed to the thought that good research can proceed only if there are linked programs." This also reflects the fear of many scientists that expensive and so-called major research threatens to crush the variety of not immediately applicable basic research.

As Markl says, "it is necessary to distinguish between two levels of major research: Nobody questions the necessity for the relevant institutions. But it would be wrong to arouse the impression that this represents the essence of research, because there is another level: The even larger-scale projects on an international scale. We need to ask ourselves: How many such major commitments is a country able to meaningfully handle, however productive it may be? I would have profound objections if the government were to say that we must be involved, whatever the circumstances. I do not wish to contest foreign policy interests, but we are duty bound to protest once we approach dimensions likely to adversely affect the breadth of basic research. That applies above all to the many space projects." To preclude any misunderstandings: As concerns SDI, Markl sees no reason "why we should be consulted at all," with regard to Eureka he does not believe that the financial allocations might assume dimensions affecting the DFG.

Up till now, the research community has not been called upon to draw in its horns as a consequence of such programs. Its budget has regularly risen by 3-4 percent in recent years--not exactly opulent but just about adequate. While, 2 years ago, a financial expert described the situation as "extremely critical," it has since improved. At the time, grant applications suddenly jumped, probably due to the wave of cuts at the universities and the poor labor market situation confronting many scientists. The experts were compelled to be increasingly strict with regard to their selections, and--in the so-called gray plan on assignments and financing in the period 1983-1986--fears were expressed that "the threat of scientifically unjustified rejection was (rising) steadily." The situation is less tense now, and Markl comments: "It would be wrong and counterproductive for me to indulge in vociferous complaints."

Nevertheless, even in Germany limits have been imposed on the spirit of research. To cite an example--the list of initiatives for the constitution of new special research projects is long; by no means all of them can be financed. It is indisputable, though, that this tool (introduced in 1969) has changed the DFG also. More than 30 percent of its current budget are spent on financing such special research projects. Admittedly, normal procedures--that is unplanned research--still represent the core of the DFG's work, but something fundamentally new has taken root.

Nor is it indisputable that all this affects the universities. Once the student population begins to decline in the 1990's, the universities will be compelled to try and attract students. By that time, the special research projects will have done much to more sharply define the profile of some universities, giving it an advantage over others. According to Markl, "we will see two kinds of attitudes at the universities. One will be: We will lasso every last person because this buoys up our statistics. The other: We will make sure that undergraduates will prefer to study here, because our graduates are valued and get jobs. The first will turn out to be the poorer strategy. The DFG, for its part, will have provided the appropriate advance performance by instituting special research projects even in hard times. After all, these yield key factors for instruction, too. I simply cannot see -nything whatever wrong with sharper differences arising among our universities as far as teaching is concerned as well."

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An Unknown Giant

Despite an annual budget amounting to almost DM1 billion in 1985, the German Research Community is an unknown giant to the general public. At the same time it is indispensable to Federal German science because it is its central organ for self-administration. Universities, academies of sciences and scientific federations are the members of the association established in 1920. However, the DFG is not financed by its members but (except for a subsidy from the donor association) by moneys from the Federation and the Laender (50 percent each), with respect to the currently 172 special research projects in a ratio of 75 : 25. Any German scientist may apply for grants. Applications are submitted for a term of 4 years by Federal German scholars amd accompanied by expert opinions of specialists chosen for the various disciplines.

As regards the grants it distributes, the DFG distinguishes four procedures. The most important one is the normal procedure on which some DM377 million were spent in 1985. Here scientists are helped with projects they have chosen themselves, by the payment, for example, of travel or printing expenses. In the key point procedure, researchers from various institutes cooperate for a limited time within the framework of a project. Research groups are established for a longer term to work on a project in the same location. In the case of special research projects, scientists congregate to work together for 12-15 years. A precondition here is for the respective university to itself consider this a key point of its operations. As per a conception by the scientific advisory council in the 1960's, this is designed to concentrate personell and material equipment and allow for interdisciplinary cooperation.

The DFG has many additional tasks, for example the promotion of the scientific library system and, above all, the provision of advice on science matters for parliaments and official agencies.

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TECHNOLOGY TRANSFER

DANISH COMPUTER TECHNOLOGY TO INDIA FOR MARKET SHARE

Copenhagen BERLINGSKE TIDENDE in Danish 10 Mar 86 Sect III p 3

[Article by Henning Gøtz: "Data Elektronik Into the Indian Market"]

[Text] The exchange-registered Dansk Data Elektronik computer firm in Herlev is extending its activities to the otherwise very closed Indian market. The firm has entered into a manufacturing agreement with one of India's largest concerns which, among other things, means the transfer of Danish technology to India.

In an attempt to push itself into the extremely protectionist Indian market, the Herlev Dansk Data Elektronik firm, DDE, has entered into an agreement with one of India's 10 largest private industrial firms regarding the transfer of technology.

DDE Director Bo Øhrstrøm does not want to put numbers on the "great expectations" for the Indian market to BERLINGSKE TIDENDE's industry reporters, but the agreement means that the Danish firm's so-called Supermax computers will henceforth be assembled in India for the Indian market, but with the exportation of Danish knowledge, computer components and operating systems.

"That we chose this course in order to get our products sold in India is due to a great extent to the country's new industrial policy, which, among other things, has resulted in unusually high duty limits for the importation of technology products."

Customs Duties of 200 Percent

"The duty limits go as high as 200 percent on ready-manufactured technology products and up to 75 percent on components, and it is in light of this that we entered into an agreement with the ORG Systems company under the ASE concern in India," Bo Øhrstrøm reports.

He reports that DDE together with the Indian company recently took part in a show in Calcutta, India, and there DDE received "very fine reactions and reports back" on its computers.

Factory in India

ORG Systems has already built in India a 400-square-meter factory, which has been set up with a view toward manufacturing the Danish computer.

Dansk Data Elektronik's 200 domestic personnel reported sales of 157 million kroner in the 1984-85 fiscal year, which gave a profit before taxes of 28 million kroner.

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TECHNOLOGY TRANSFER

AUSTRIA: INCREASED COMPUTER EXPORT TO COMECON COUNTRIES

Vienna DIE PRESSE in German 12 Mar 86 p 9

[Article by Erich Hoorn: "More Loopholes for Export of Computers to Comecon Countries"]

[Text] Most of the American computer companies doing business in Vienna have recently been able to expand their business with the Comecon area. This was made possible through the revision of the embargo list of the Coordination Committee for East-West Trade in Paris, which is known under the English abbreviation of Cocom. Because computers are becoming increasingly smaller and the Soviet secret service, the KGB, can easily smuggle them in a briefcase, the delivery of small systems was liberalized somewhat as of 1 January 1985. In the case of medium-size computer systems, too, exports to the East are possible, according to statements of the Austrian branch establishment of Control Data Corporation (CDC). To be sure, it was pointed out, strict guidelines apply here and "allowances are never made." "However, as far as export to Comecon countries is concerned, you can forget the large equipment entirely," CDC-director Helmut Koller is aware. He emphasizes though that it proved possible to expand the CDC-business with the East during the preceding year.

The managing director of the Vienna-based eastern subsidiary of IBM, ROECE, Eugen Hahn, emphasizes with relief that the technological parameters of the computers that may be exported to the East have now been fixed at a higher level. The process of the issue of export licenses by the U.S. government and the Comcom has reportedly accelerated. ROECE is responsible for the small Comecon countries, as well as for Yugoslavia, for which, however, export licenses are de facto handled as those for the Western countries. Hahn registers "a steady business" with the East.

Euphoric comments about the market in the East come from the managing director of the Austrian subsidiary of Hewlett Packard (HP), Anton Polsterer: During the preceding year it proved possible to register a 50-percent increase in sales to 539 million schillings in the Comecon and Yugoslavia. HP has the advantage that especially small equipment is being supplied. The greatest successes in the East are being attained with computers for work places for research, with CAD [computer-aided design], measuring systems, graphic output devices, and electronic equipment for use in medicine. The largest market is Yugoslavia. Hungary and the CSSR follow in second and third place. Even Poland purchased more equipment during the preceding year. Now Polsterer is

hoping for the Soviet market, where he has held "very promising discussions." The GDR is traditionally a small market for HP because it is supplied, above all, by German firms.

People in the Vienna subsidiary of Digital Equipment Corporation (DEC), on the other hand, are pessimistic about the market in the East: The company cannot supply any equipment because all of it is included in the embargo list. Only service transactions are still being carried out there.

Properly considered, the Comecon area is still developing country with respect to computers. Most of the equipment that is installed there has in the West belonged into the Technical Museum. Depending on the group of the installations, the backwardness is estimated to be 5 to 15 years. Computer density, too, especially in the USSR, is surprisingly low. For the weakness of the communist countries is not so much the development of prototypes, small series production or single-item manufacture for space travel or military technology. Difficulties exist, above all, in the mass production of computers and their broad use in the national economy. For this reason, the party congress of the Soviet communist party, which has just been concluded in Moscow, has advanced the catching up with the West in technology as one of the most important goals.

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TECHNOLOGY TRANSFER

GE CALMA PROVIDES AUTOMATION SUPPORT TO YUGOSLAV FIRMS

Milan AUTOMAZIONE OGGI in Italian No 14, Feb 86 pp 18, 20

[Text] GE Calma has obtained a work order from the Yugoslav company Prva Petoletka Trstenikk (PTT) to supply CAD/CAM systems for a total amount of about 2 billion lire.

The order is made up of six Apollo work stations equipped with the software systems Geomond, DDM (Design, Drafting and Manufacturing) and T-boards for the planning of printed circuits as well as mechanical devices.

The Geomond software solid modeling system is used to connect the geometrical models of different components in complete structural systems, before passing to the finished product for drawings of detail with the DDM. The DDM range of products is made up of a dozen packages for both modeling and mechanical planning. All these software systems will give PTT the opportunity to devise three-dimensional immages of the details of its oil hydraulic and pneumatic equipment. Moreover, it makes it possible to follow the various stages from the simulation of the drawings to the numerical control tape documentation and preparation.

T-boards is a standard system devised for the design of logical systems and cards for printed circuits. Moreover, it offers an interactive environment for the general drawing, packing, and other stages of electronic product definition. The central database stores all the information which is needed for the planning of the printed circuit board. After the layout setting, the T-boards present the final documentation, the digital information for "masters" production, as well as the CAM interfaces for the tapes of the numerical control punch and connection machines.

GE Calma has been part of the General Electric Group since 1981. From that time its business volume has increased by an annual average rate of 30 percent on the worldwide market and 40 percent on the continental market. In Italy, GE Calma since 1982 has been operating as a division of CGE--Compagnia Generale di Elettricita, a company of the General Electric Group. PTT is a leading Yugoslav company in the field of hydraulic and pneumatic equipment. It exports 30 percent of its production to European countries, the Middle East, the Soviet Union, and the United States.

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TECHNOLOGY TRANSFER

BRIEFS

FINLAND, CHINA S&T NEGOTIATIONS--Finland has begun negotiations with the People's Republic of China on the signing of an agreement on collaboration. The negotiations are based on a Chinese initiative. This agreement is felt to be recommendable since it is anticipated that the economic, scientific and technological modernization programs to be carried out in China will offer opportunities for collaboration in the fields of science and technology between the two countries. The agreement would offer Finland an opportunity to establish direct collaborative relations with China's State Science and Technology Commission. An increase in trade between Finland and China also speaks in favor of this expansion of cooperation. Last year Finland exported 548 million markkas worth of goods to China and imported 216 million markkas worth. The president of the republic has ordered foreign affairs advisor Teppo Takala to head Finland's negotiators. [Text] [Helsinki HELSINGIN SANOMAT in Finnish 1 Mar 86 p 11] 11466

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